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# SURVEY of FRUIT & TREE NUT USE by FROZEN DESSERT MANUFACTURERS

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## SUMMARY

The frozen dessert industry used around 112 million pounds of fruits and berries (fresh weight equivalent) during 1953 in the wholesale manufacture of ice cream and related products. This figure excludes the large quantities of fruits and fruit products used as toppings or served along with frozen desserts.

About 80 percent of these 112 million pounds of fruits used by the frozen dessert industry was purchased in frozen form, compared with about 18 percent in canned or other nonfrozen processed forms. Only 2 percent was obtained as fresh fruit.

Comparing this industry's use of fruit with estimated fruit usage of other major food manufacturing industries provides a measure of the relative importance of this industry as a consumer of fruits and fruit products. In 1953, preservers used around 300 million pounds. Wholesale, multi-unit retail, and door-to-door distributing bakers reported purchases of about 140 million pounds of fruit.

Frozen fruit purchases by the frozen dessert industry were equivalent to 12 percent of the total 1953 commercial frozen fruit pack (excluding citrus juice concentrates), and more than 18 percent of the commercial pack in containers 10 pounds or larger. These overall pack relationships, however, tend to understate the relative importance of this outlet for specific frozen fruits and berries.

The frozen dessert industry used over 45 million pounds (frozen weight) of strawberries. This was around 20 percent of the total 1953 frozen strawberry pack, or about 43 percent of the quantity packed in large-sized containers. Over 10.5 million pounds of frozen peaches were used in 1953. This was equivalent to almost one-third of the total frozen pack, or about 78 percent of the commercial pack in containers 10 pounds or over. This industry's consumption of frozen red raspberries in 1953 amounted to about one-fourth of the total frozen pack.

The frozen dessert industry is not only a major outlet for frozen fruits; in several respects it is also a specialized market. Evaluations of fruit quality are based in part upon characteristics of the fruit as required in the manufacturing process and in part upon the end product--ice cream or sherbet, for example. Flavor is reported to be a dominant quality consideration, and includes such aspects as flavor strength and bouquet and preventing undesirable after-taste or flavor changes ("fading out" or "building up" of flavors between manufacture and consumption). Color and texture of the finished product are also quality factors. Tenderness, size, and color of fruit particles affect end product quality as does formation of ice crystals within such fruit particles.

It is estimated that fruit-flavored ice creams, sherbets, and water ices currently account for almost one-fourth of all frozen dessert production. According to the International Association of Ice Cream Manufacturers, fruit-flavored ice creams, including fruit-nut combinations, constituted about 19

percent of total ice cream production during 1952. Strawberry ice creams, alone, accounted for almost 10 percent. Production of all fruit-flavored items combined was slightly greater than that of chocolate-flavored ice creams.

There were 174 flavors of ice creams manufactured commercially during 1952. However, the 3 leading flavor groups--vanilla, chocolate, and strawberry--accounted for almost 80 percent of total production. Fruit-flavored ice creams must compete for consumer acceptance with a wide variety of flavors as well as established flavor acceptance patterns.

Using published projections as to population and income growth, as well as information gathered in this study, we projected future fruit requirements of this industry. This projection is not designed as a "forecast," but is an estimate based upon a set of assumptions. Outside forces could change fruit requirements within the next 20 years.

By 1975, total consumption of frozen desserts might be expected to reach around 1,200 million gallons--an increase of more than 60 percent over 1953 levels. About two-thirds of such an increase could result from population growth and the bulk of the remainder from rises in spendable income in the hands of consumers.

Fruits and fruit products, however, are used in only a small portion of total frozen dessert production--probably around 23.5 percent in 1953. Any change in this share would have a major effect upon total fruit requirements in this industry. In recent years there appears to have been a limited upward trend in relative importance of fruit-flavored frozen desserts. If this trend were to continue at one-half the current rate, fruit-flavored items would constitute slightly over one-fourth of total frozen dessert output. On this basis, 1975 total production of fruit-flavored frozen desserts might be around 70 percent greater than in 1953. Such an increase would establish requirements for fruits at around 190 million pounds (fresh weight equivalent), or about 78 million pounds over 1953 levels. In 1953 about 80 percent of all fruits used were purchased in frozen form. If frozen fruits continue to be purchased at the 1953 ratio to total fruit requirements, purchases by 1975 of frozen fruits would stand at around 150 million pounds compared with about 90 million pounds in 1953.

If these changes were to occur at a relatively even rate, demand for all fruits, including frozen, might be expected to rise about 3 1/2 percent each year from 1953 levels. Thus, the impact of such significant long-range increases in demand would tend to be relatively limited in scope when viewed on an annual or short-run basis.

An estimated 27 million pounds of tree nuts and peanuts (unshelled weight) were used in frozen dessert manufacture during 1953. Pecans constituted over 12 million pounds of this total. The quantities of pecans and almonds used were each equivalent to about 6 percent of total domestic production sold in 1953, whereas the usage of English walnuts was about 3 percent of total domestic production in that year.

# SURVEY OF FRUIT AND TREE NUT USE BY FROZEN DESSERT MANUFACTURERS

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## BACKGROUND OF STUDY

Increasing quantities of agricultural products are being marketed in frozen form. What is the present and potential impact of this increase upon agricultural marketing? This study of fruit use by ice cream manufacturers is one of a series to measure the relative size and nature of each of the major markets for frozen fruits and berries.

More than 65 percent of the 1953 frozen fruit and berry pack, excluding frozen juice concentrates, was in the large-sized containers used by food manufacturers and institutional trade. The bulk of this pack was consumed by ice cream manufacturers, preservers, pie bakers, restaurants, and cafeterias.

The aim of this survey was to answer the following questions:

1. How much frozen fruit is used in frozen dessert manufacturing?

2. How does this volume of frozen fruits compare with the quantities of fresh and canned fruits used?

3. What suggestions does this industry offer for improving frozen fruits to meet its needs?

4. What is the outlook for future use of frozen fruits in frozen dessert manufacture?

In addition to information on use of fruits, data were collected on purchase of tree nuts and peanuts during 1953 for use in the manufacture of ice cream and related products. These data do not include purchases of fruits or nuts for use as toppings.

In this survey, efforts were made to contact all wholesale ice cream manufacturers with an output of 50,000 gallons and over. To facilitate State and regional comparisons, reports on a State basis were requested from multi-State operators.

Mail questionnaires were forwarded to 1,462 wholesale ice cream manufacturers. A cluster sample of about 12 percent of the nonrespondent firms was contacted later by personal interview.

Production information was obtained from 813 firms (table 1). An additional 30 firms reported doing no manufacturing during 1953 or having consolidated with other operators. Total frozen dessert production in 1953 by respondents was over 363 million gallons. This is equivalent to about 66 percent of total wholesale ice cream production during that year, or about 60 percent of the production of ice cream (wholesale), sherbets, and water ices--the frozen desserts which account for most fruits and nuts used in this industry.

Table 1.--Number of wholesale ice cream manufacturers and output, by regions, 1953

| Region and division | Manufacturers | | Output | | |
|---|---|---|---|---|---|
| | Total in sample | Firms reporting 1/ | Industry total 2/ | Reported by respondents 3/ | Respondents percentage of total |
| | Number | Number | Million gallons | Million gallons | Percent |
| Northeast | 288 | 172 | 167.9 | 113.6 | 68.0 |
| North Central: | | | | | |
| East North Central | 383 | 204 | 126.0 | 72.6 | 57.6 |
| West North Central | 207 | 111 | 55.5 | 38.6 | 69.5 |
| Total | 590 | 315 | 181.5 | 111.2 | 61.3 |
| South: | | | | | |
| South Atlantic | 127 | 79 | 66.2 | 35.3 | 53.3 |
| South Central | 240 | 115 | 61.6 | 37.4 | 60.7 |
| Total | 367 | 194 | 127.8 | 72.7 | 56.9 |
| West | 217 | 132 | 72.2 | 66.1 | 91.6 |
| Total | 1,462 | 813 | 548.6 | 363.6 | 66.3 |

1/ Includes some individual State production reports by multi-State operators. Excludes 23 firms reporting no manufacturing in 1953 and 7 firms with reports consolidated under other companies.

2/ Wholesale ice cream production only.

3/ Includes some frozen dessert production other than ice cream.

Estimates as to quantities of fruits and tree nuts used by nonresponding firms were made by relating average fruit use per unit of frozen dessert production as found in the survey to total production of ice cream and related products as published by USDA. Expansions were made on a State basis and estimates of national and regional fruit usage were obtained from the total of State estimates. 1/

1/ Production characteristics in the sample of nonrespondents appear to approximate closely those of the respondent firms. This fact, together with the large size of the sample, would indicate the validity of using this simplified method of estimate. Data for total production obtained from "Production of Manufactured Dairy Products, 1953," Stat. Bul. No. 152, Agr. Mktg. Service, U. S. Dept. Agr., Dec. 1954.

## HOW MUCH FRUIT WAS USED IN THE MANUFACTURE OF FROZEN DESSERTS DURING 1953?

### Overall Fruit Usage

It is estimated that almost 112 million pounds of fruits and berries (fresh weight equivalent) 2/ were used in the manufacture of ice cream and related products during 1953. Related products include sherbets, ice milk, other frozen dairy products, water ices, and mellorine. (Mellorine includes all frozen desserts made with a vegetable fat, meat fat, or a combination thereof in place of butterfat.) These fruits 3/ were obtained in processed-frozen and nonfrozen and fresh forms. This figure excludes the large quantities of fruits and fruit products used as toppings or served in conjunction with frozen desserts.

A comparison with estimated fruit usage by the preserving and pie baking industries tends to emphasize the importance of the frozen dessert industry as an outlet for fruits. Preservers in 1953 used about 300 million pounds of fruits. During that year, reported purchases of fruits by wholesale, multi-unit retail, and door-to door distributing bakers amounted to about 140 million pounds.

### Use of Specific Fruits and Berries

Strawberries were the most important fruit used in frozen dessert manufacture, accounting for over 36 percent of all fruits used (table 2). The 5 leading fruits--strawberries, oranges, peaches, cherries, and pineapples--accounted for over 81 percent of total fruit use. The next 5--limes, red and black raspberries, lemons, and bananas--represented another 15 percent. Thus, 10 fruits constituted over 97 percent of all fruits used in the manufacture of ice cream and related products during 1953.

### Location of the Frozen Dessert Market for Fruits

Table 3 shows the estimated quantities of individual fruits and berries used in the manufacture of frozen desserts in each of 4 major regions during 1953. From this, it is apparent that these regions vary widely in importance as markets for fruits, both in the overall and for individual items.

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2/ Fresh weight equivalents were used to obtain comparability among frozen, fresh, canned fruits, juices, and purees. The fresh weight equivalent is often less than product weight, since no allowance is made for sugars or syrups added in fruit canning or freezing operations.

3/ In this report, the term "fruits" generally includes fruits and berries.

Table 2.--Estimated quantity of specified fruits used in the manufacture of ice cream and related products, United States, 1953

(Fresh weight equivalent)

| Fruit | Million pounds | Percentage of total |
|---|---|---|
| Strawberries | 40.7 | 36.4 |
| Oranges | 22.8 | 20.4 |
| Peaches | 12.8 | 11.4 |
| Cherries | 8.4 | 7.5 |
| Pineapples | 6.7 | 6.0 |
| Limes | 5.9 | 5.3 |
| Red raspberries | 3.9 | 3.5 |
| Lemons | 3.3 | 3.0 |
| Black raspberries | 2.2 | 2.0 |
| Bananas | 2.0 | 1.8 |
| Tangerines | 1.7 | 1.5 |
| Nectarines | .2 | .2 |
| Others | 1.1 | 1.0 |
| Total | 111.7 | 100.0 |

Table 3.--Estimated quantity of specified fruits used in the manufacture of frozen desserts, by regions, 1953

(Fresh weight equivalent)

| Fruit | Northeast | North Central | South | West | United States |
|---|---|---|---|---|---|
| | Million pounds | Million pounds | Million pounds | Million pounds | Million pounds |
| Strawberries | 17.6 | 10.2 | 8.9 | 4.0 | 40.7 |
| Oranges | 7.9 | 8.0 | 5.4 | 1.5 | 22.8 |
| Peaches | 6.9 | 1.7 | 3.6 | .6 | 12.8 |
| Cherries | 4.6 | 2.2 | 1.2 | .4 | 8.4 |
| Pineapples | 1.8 | 2.4 | 2.0 | .5 | 6.7 |
| Limes | 1.1 | 1.2 | 3.4 | .2 | 5.9 |
| Red raspberries | 2.0 | 1.1 | .3 | .5 | 3.9 |
| Lemons | 1.2 | 1.3 | .5 | .3 | 3.3 |
| Black raspberries | 1.2 | .7 | .2 | .1 | 2.2 |
| Bananas | 1.0 | .4 | .6 | --- | 2.0 |
| Tangerines | .3 | .2 | 1.2 | --- | 1.7 |
| Nectarines | --- | --- | --- | .2 | .2 |
| Others | .3 | .6 | .1 | .1 | 1.1 |
| Total | 45.9 | 30.0 | 27.4 | 8.4 | 111.7 |

A comparison of the percent of total fruit use, frozen dessert production, and population found in each of these regions is shown in table 4. It is evident that the geographic distribution of fruit use in this industry does not follow closely the national frozen dessert production pattern. It bears even less relationship to concentration of population. For example, firms in the Northeastern States used over 40 percent of the fruit, whereas about 28 percent of the frozen dessert production took place in this region, and less than 26 percent of the population was located there.

Table 4.--Percentage distribution of fruit used in the manufacture of frozen desserts, production of frozen desserts, and of population, by regions, 1953

| Region | Total fruit use 1/ | Frozen dessert production | Population |
|---|---|---|---|
| | Percent | Percent | Percent |
| Northeast 2/ | 41.0 | 28.2 | 25.7 |
| North Central 3/ | 26.7 | 32.4 | 29.2 |
| South 4/ | 24.6 | 23.9 | 31.3 |
| West 5/ | 7.7 | 15.5 | 13.8 |
| United States | 100.0 | 100.0 | 100.0 |

1/ Fresh weight equivalent.
2/ New England and Middle Atlantic divisions.
3/ East North Central and West North Central divisions.
4/ South Atlantic and South Central divisions.
5/ Mountain and Pacific divisions.

When regional usage of specific fruits and berries is examined, it is apparent that the location of the market for each item must be considered separately. Table 5 provides a measure of the extent of regional differences in use of 3 major fruits--strawberries, peaches, and cherries. Ratios were developed as to fruit use and total wholesale ice cream production (all flavors). Fruit use was expressed as pounds per 100 gallons of ice cream production. Although some of these fruits may have been used in the manufacture of other frozen desserts, these ratios should provide a working indicator as to relative levels of fruit usage in these regions.

It would appear that national use of strawberries was equivalent to almost 7.5 pounds for each 100 gallons of ice cream produced. However, usage ranged from about 4.8 pounds in the West North Central States to 10.6 pounds per 100 gallons in the Northeast region. Greater regional variations are indicated in the use of peaches and cherries. Firms in the West North Central States used about 0.6 pounds of peaches per 100 gallons of ice cream produced, whereas use of peaches reached 4.1 pounds in the Northeastern and 3.4 pounds in South

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Atlantic States. Western operators used about 0.6 pound of cherries compared with 2.7 pounds consumed in the Northeast.

Table 5.--Quantities of selected fruits used per 100 gallons of wholesale ice cream (all flavors), by regions, 1953

| Region and division | Wholesale ice cream production | Strawberries | Peaches | Cherries |
|---|---|---|---|---|
| | Million gallons | Pounds | Pounds | Pounds |
| Northeast | 167.1 | 10.6 | 4.1 | 2.7 |
| North Central | 181.5 | 5.6 | .9 | 1.2 |
| East North Central | 126.0 | 6.0 | 1.0 | 1.4 |
| West North Central | 55.5 | 4.8 | .6 | .9 |
| South | 127.8 | 7.0 | 2.8 | 1.0 |
| South Atlantic | 66.2 | 7.4 | 3.4 | 1.2 |
| South Central | 61.6 | 6.5 | 2.2 | .7 |
| West | 72.2 | 5.5 | .9 | .6 |
| United States | 548.6 | 7.4 | 2.3 | 1.5 |

When adjustments are made for the effect of regional differences in total ice cream production, it would appear that usage of strawberries in the area of highest use was more than double that found in the area of lowest consumption. The range for peaches was almost 7 times, and 4 1/2 times for cherries. These wide regional differences are due in part to regional variations in relative importance of frozen desserts containing these fruits. Intensity of use, or the volume of fruit used per gallon of the fruit-flavored frozen dessert, may also be a factor.

## Form in Which Fruits Are Used

The frozen dessert industry purchased fruits, juices, and purees in fresh, frozen, and canned 4/ form. Table 6 shows quantities of fruits used in each of these forms, and table 7 shows this information as percentages of total use.

Almost 80 percent of fruits were used in frozen form, compared with about 18 percent in canned or other nonfrozen forms. Only 2 percent was obtained as fresh fruit. Each major fruit used in frozen dessert manufacture was purchased primarily in frozen form except for cherries and pineapples. Canned or preserved fruits accounted for the bulk of the remaining purchases. Bananas were the only fruit in which a sizable segment of purchases were of fresh fruit.

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4/ Including all other nonfrozen processed fruit products.

Table 6.--Estimated quantities of fruits used fresh and in processed form by manufacturers of frozen desserts, United States, 1953 1/

(Fresh weight equivalent)

| Fruit | Fresh | Processed | | Total |
|---|---|---|---|---|
| | | Frozen | Nonfrozen | |
| | 1,000 pounds | 1,000 pounds | 1,000 pounds | 1,000 pounds |
| Strawberries | 674 | 36,614 | 3,407 | 40,696 |
| Peaches | 385 | 11,839 | 564 | 12,788 |
| Cherries | 210 | 2,847 | 5,331 | 8,388 |
| Black raspberries | 5 | 1,561 | 672 | 2,238 |
| Red raspberries | 40 | 3,409 | 424 | 3,873 |
| Pineapples | 12 | 1,173 | 5,496 | 6,681 |
| Bananas | 590 | 1,373 | 87 | 2,049 |
| Nectarines | 11 | 196 | 24 | 231 |
| Oranges | 295 | 19,779 | 2,750 | 22,824 |
| Lemons | 36 | 2,846 | 454 | 3,336 |
| Limes | 79 | 5,323 | 542 | 5,945 |
| Tangerines | --- | 1,679 | 11 | 1,690 |
| Others | 12 | 277 | 850 | 1,139 |
| Total | 2,349 | 88,916 | 20,612 | 111,877 |

1/ Includes fruits, juices, and purees.

Table 7.--Percentage of fruits used fresh and in processed form by manufacturers of frozen desserts, United States, 1953 1/

(Fresh weight equivalent)

| Fruit | Fresh | Processed | | Total |
|---|---|---|---|---|
| | | Frozen | Nonfrozen | |
| | Percent | Percent | Percent | Percent |
| Strawberries | 1.7 | 89.9 | 8.4 | 100.0 |
| Peaches | 3.0 | 92.6 | 4.4 | 100.0 |
| Cherries | 2.5 | 33.9 | 63.6 | 100.0 |
| Black raspberries | .2 | 69.8 | 30.0 | 100.0 |
| Red raspberries | 1.0 | 88.0 | 11.0 | 100.0 |
| Pineapples | .2 | 17.5 | 82.3 | 100.0 |
| Bananas | 28.8 | 67.0 | 4.2 | 100.0 |
| Nectarines | 4.7 | 84.9 | 10.4 | 100.0 |
| Oranges | 1.3 | 86.7 | 12.0 | 100.0 |
| Lemons | 1.1 | 85.3 | 13.6 | 100.0 |
| Limes | 1.3 | 89.6 | 9.1 | 100.0 |
| Tangerines | --- | 99.4 | .6 | 100.0 |
| Others | 1.1 | 24.3 | 74.6 | 100.0 |
| Total | 2.1 | 79.5 | 18.4 | 100.0 |

1/ Includes fruits, juices, and purees.

## Regional Use of Fruits--by Form

As shown in table 8, the bulk of fruits used by frozen dessert manufacturers in each region was received in frozen form. Manufacturers in the Middle Atlantic, Northeast, and New England States used frozen fruits to the greatest extent, and North Central operators the least. Southern and Western manufacturers used about the same percent of their fruits in frozen form. Operators in the Western region appear to have used a slightly greater percentage of fresh fruits than those in other regions. However, even in the West, fresh fruits accounted for only about 3 percent of the total and the interregional difference may not be significant statistically.

Table 8.--Proportion of fresh and of processed fruits purchased for the manufacture of frozen desserts, by regions, 1953

| Region | Fresh | Processed | | Total |
|---|---|---|---|---|
| | | Frozen | Nonfrozen | |
| | Percent | Percent | Percent | Percent |
| Northeast | 2.3 | 86.2 | 11.5 | 100.0 |
| North Central | 1.5 | 69.9 | 28.6 | 100.0 |
| South | 2.2 | 79.3 | 18.5 | 100.0 |
| West | 3.0 | 77.5 | 19.5 | 100.0 |
| United States | 2.1 | 79.5 | 18.4 | 100.0 |

Table 9 shows the percent of specific fruits that were purchased by dessert manufacturers in frozen form by regions and for the United States. It would appear that for most fruits there was relatively little regional variation as to the percent obtained in frozen form. However, relatively wide variations were noted for pineapples, black raspberries, and cherries. For these items there was considerably greater use of the frozen product in the Northeast than in the other regions.

## Relative Importance of Frozen Dessert Outlet for Frozen Fruits

A measure of the relative importance of the frozen dessert industry as a market for frozen fruits is obtained by comparing reported use of frozen fruits by this industry during 1953 with commercial frozen fruit pack data for the same year. This is not an absolute measure, however, since some fruits used in 1953 would have been obtained from earlier frozen fruit packs. Also, it is possible that some of the frozen fruits used may have been custom-packed and not reported in the commercial pack statistics.

As shown in table 10, use of frozen fruits by this industry in 1953 was equivalent to 12 percent of the total commercial frozen fruit pack (excluding

citrus juice concentrates) of that year. It was equal to over 18 percent of the total pack in containers 10 pounds or larger--the size of containers customarily used by food manufacturers.

Table 9.--Percentage of fruits used in frozen form, by region, in frozen dessert manufacturing, 1953

| Fruit | Northeast | North Central | South | West | United States |
|---|---|---|---|---|---|
| | Percent | Percent | Percent | Percent | Percent |
| Strawberries | 96.1 | 83.9 | 84.8 | 89.7 | 90.0 |
| Peaches | 97.4 | 85.5 | 87.7 | 86.4 | 92.6 |
| Cherries | 50.4 | 15.5 | 17.0 | 4.1 | 33.9 |
| Black raspberries | 80.8 | 62.4 | 49.2 | 41.3 | 69.8 |
| Red raspberries | 90.6 | 82.1 | 82.0 | 94.5 | 88.0 |
| Pineapples | 47.4 | 1.7 | 5.6 | 32.3 | 17.6 |
| Bananas | 64.9 | 73.1 | 66.4 | 70.5 | 67.0 |
| Nectarines | 100.0 | 65.5 | 67.9 | 97.8 | 85.0 |
| Oranges | 88.1 | 82.4 | 92.7 | 80.2 | 86.7 |
| Lemons | 84.1 | 87.4 | 89.1 | 75.0 | 85.3 |
| Limes | 83.3 | 81.6 | 96.7 | 55.7 | 89.6 |
| Tangerines | 97.8 | 99.9 | 99.7 | 100.0 | 99.4 |
| Others | 39.5 | 12.7 | 15.9 | 54.9 | 24.3 |
| Total or average | 86.2 | 69.9 | 79.3 | 77.5 | 79.5 |

Table 10.--Quantity of specified frozen fruits and percentage used by frozen dessert industry, other than citrus, 1953

| Fruit | Total quantity (frozen weight) | Percentage used by frozen dessert industry | |
|---|---|---|---|
| | | Of total quantity frozen | Of pack in 10-pound or over containers |
| | 1,000 pounds | Percent | Percent |
| Strawberries | 45,203 | 20.0 | 43.5 |
| Peaches | 10,570 | 32.9 | 78.0 |
| Red raspberries | 3,246 | 13.0 | 25.1 |
| Cherries | 2,997 | 2.6 | 2.6 |
| Black raspberries | 1,487 | 16.6 | 16.6 |
| Others | 2,524 | 1.9 | 2.2 |
| Total | 66,027 | 12.2 | 18.2 |

The volume of frozen strawberries used in this industry, however, was equivalent to 20 percent of the total frozen pack of this item, or about 43 percent of the total frozen strawberries packed in large-sized containers. Industry consumption of frozen peaches was equivalent to almost one-third of the entire frozen pack, or 78 percent of the pack in containers 10 pounds or over. The industry also accounted for a sizable portion of the frozen red and black raspberry pack. The important position of the frozen dessert industry in the marketing of frozen fruits, particularly of frozen peaches and strawberries, is evident and indicates the importance of recognizing the specialized requirements of this market for frozen fruits.

## Use of Tree Nuts and Peanuts by Frozen Dessert Industry

It is estimated that almost 27 million pounds of tree nuts and peanuts (farm weight equivalent) were used in the manufacture of frozen desserts during 1953. This does not include the large quantities used as toppings. Pecans were the most important item, representing about 45 percent of the total. Almonds, peanuts, and English and black walnuts also were used heavily--named in order of importance (table 11).

Table 11.--Quantity of tree nuts and peanuts used in frozen dessert manufacture, by regions, and United States, 1953

(Unshelled weight)

| Nuts | Northeast | North Central | South | West | United States |
|---|---|---|---|---|---|
| | 1,000 pounds | 1,000 pounds | 1,000 pounds | 1,000 pounds | 1,000 pounds |
| Pecans | 3,881 | 3,892 | 3,498 | 865 | 12,136 |
| Almonds | 2,583 | 1,200 | 409 | 477 | 4,669 |
| Peanuts 1/ | 187 | 2,342 | 756 | 334 | 3,619 |
| English walnuts | 2,076 | 464 | 125 | 808 | 3,473 |
| Black walnuts | 97 | 990 | 838 | 362 | 2,287 |
| Pistachio | 69 | 39 | 15 | 29 | 152 |
| Others | 61 | 423 | 104 | 45 | 633 |
| Total | 8,954 | 9,350 | 5,745 | 2,920 | 26,969 |

1/ May include some quantities used in coatings for ice cream specialties.

As in the case of fruit-flavored items, production of nut-flavored ice cream appears to follow a distinctive geographic pattern. Table 12 shows ratios between use of selected tree nuts and wholesale ice cream production for the 4 major regions.

Table 12.--Quantities of selected tree nuts used in wholesale ice cream production, by regions, 1953

| Region | Wholesale ice cream production | Per 100 gallons of ice cream (all flavors) | | | |
|---|---|---|---|---|---|
| | | Pecans | Almonds | English walnuts | All tree nuts and peanuts |
| | Million gallons | Pounds | Pounds | Pounds | Pounds |
| Northeast | 167.1 | 2.3 | 1.5 | 1.2 | 5.4 |
| North Central | 181.5 | 2.1 | .7 | .3 | 5.2 |
| South | 127.8 | 2.7 | .3 | .1 | 4.5 |
| West | 72.2 | 1.2 | .7 | 1.1 | 4.0 |
| United States | 548.6 | 1.7 | 0.9 | 0.6 | 4.9 |

From these data it would appear that usage of all tree nuts and peanuts parallels total ice cream production by region, ranging between 4.0 and 5.4 pounds per 100 gallons of ice cream output (all flavors). There appears to be a tendency for the more northerly regions to use larger quantities of tree nuts and peanuts per unit of ice cream. An analysis of use on a State basis showed the northerly tiers of States from the Atlantic Seaboard to the Rocky Mountains as consistently heavy users of these products.

Although there are relatively small regional variations in total use of tree nuts and peanuts, there are wide deviations in the use of individual items. Individual tree nuts appear to have relatively wider use in their production areas--pecans in the South and English walnuts and almonds in the West, for example. Southern frozen dessert manufacturers use more than double the amounts of pecans per 100 gallons of ice cream than are used by Western producers. Western operators indicated usage of more than double the amount of almonds and over 10 times as many English walnuts per unit of output as was used in the South.

How important is the frozen dessert industry as a market for tree nuts? An indication of its importance is obtained by comparing estimated use during 1953 with total domestic tree nut production during that year. This provides only a rough measure, however, since a major portion of the tree nuts used by this industry during 1953 probably would have been obtained from earlier crops. Also, the frozen dessert manufacturer's purchases of some tree nuts need not have been limited to domestic supplies.

Use of pecans and almonds each appeared to be equivalent to about 6 percent of 1953 crop sales; for English walnuts, it represented about 3 percent (table 13). However, these figures are for quantities reported as used in frozen dessert manufacture and do not include the large volumes of these products known to be used as toppings or served in conjunction with frozen desserts.

Table 13.--Domestic production of specified tree nuts and quantity used in the frozen dessert industry, 1953

(In-the-shell basis)

| Nuts | Used in frozen desserts | Total domestic production 1/ | Share used in frozen desserts |
|---|---|---|---|
| | 1,000 pounds | 1,000 pounds | Percent |
| Pecans | 12,136 | 211,660 | 5.7 |
| Almonds | 4,669 | 2/ 77,200 | 6.0 |
| English walnuts | 3,473 | 3/ 108,400 | 3.2 |
| Black walnuts | 2,287 | 4/ | 4/ |
| Pistachios | 152 | 4/ | 4/ |
| Others 5/ | 633 | 4/ | 4/ |
| Total | 23,350 | 4/ | 4/ |

1/ Preliminary.
2/ California production only.
3/ California and Oregon production only.
4/ Data not available.
5/ Includes unidentified nut mixes.

## PRODUCTION OF FRUIT-FLAVORED FROZEN DESSERTS

In the frozen dessert industry, fruits and nuts are used primarily in the manufacture of ice creams, sherbets, and water ices. Some fruits and nuts may also be used in making other types of frozen desserts; however, it is reported that these items are used more often as toppings for such products. The quantity of fruits and nuts that will be used by this industry is dependent primarily upon two factors: (1) The production of fruit-flavored ice creams, sherbets, and water ices; and (2) the amounts of fruits or nuts used per gallon in this manufacture. Limited data are available as to the amounts of fruits used per gallon; however, data were obtained as to the relative importance of fruit-flavored frozen desserts.

Fruit- or nut-flavored frozen desserts constitute only a portion of the various flavored products available to the consumer. Therefore, fruit- or nut-flavored products must compete with many other flavors for consumer acceptance.

### Fruit- or Nut-Flavored Ice Creams

Ice cream is the principal frozen dessert--accounting for around 80 percent of total frozen dessert production during 1953. Between 1949 and 1953 total ice cream production rose from 558 million gallons to 602 million gallons. It has more than kept pace with the rapid rate of population growth during this

period. Per capita civilian consumption in 1953 was around 17.7 pounds (product weight) as compared with a consumption rate of 17.4 pounds per person in 1949. This relative stability in per capita consumption would indicate the possibility that ice cream has established a relatively firm position in family food purchasing patterns.

According to the International Association of Ice Cream Manufacturers, 5/ there were 174 flavors of ice cream available in 1952. Figure 1 shows the share of total ice cream production in 1952 which was represented by the major flavor groups. From this chart it is evident that 2 flavor groups, vanilla and chocolate, accounted for over two-thirds of all ice cream production. Strawberry ranked third with almost 10 percent. The "Big 3" flavors were used in almost 80 percent of 1952 ice cream production.

Fruit flavors, other than strawberry, represented about 9 percent of production, or slightly less than the volume of strawberry-flavored ice creams. Over 4 percent of ice creams contained cherry flavors, about 1.8 percent peach, and 1 percent raspberry. All other fruit flavors accounted for about 2.3 percent of total ice cream production.

Nut-flavored ice creams, including fruit-nut combinations, represented about 7.1 percent of all ice creams manufactured. Pecan ice creams accounted for 3.8 percent, or over half of this total. Maplenut was the other nut-flavored ice cream with more than 1 percent of total production.

Periodic flavor preference reports of the International Association of Ice Cream Manufacturers since 1925 indicate that the "Big 3" flavors--vanilla, chocolate, and strawberry--have accounted for between 70 and 80 percent of total ice cream production. Use of chocolate and strawberry flavors shows an increasing trend; vanilla ice cream production figures fluctuate around the 50 percent mark. Within the remaining portion of production, some flavors have risen in importance and others have fallen, but the relative position of the conglomerate flavors has remained between the relatively narrow limits of 20.5 and 27.5 percent.

Although many of the "lesser" ice cream flavors do not constitute a sizable percent of ice cream output, they represent considerable volume. Since wholesale ice cream production in 1952 was 537 million gallons, a 1-percent share of this market would have been over 5 million gallons. Some of these "lesser" flavors are important seasonal sellers; others maintain strong sales positions in specific local or regional markets.

From these data it would appear that the level of consumer acceptance for vanilla, chocolate, and strawberry ice creams is such that the many other flavors combined would have difficulty in expanding their share of the market beyond 20 to 25 percent. Thus, increases in sales of individual items in this category would be expected, at least in part, to result in decline in sales of other ice creams in this group.

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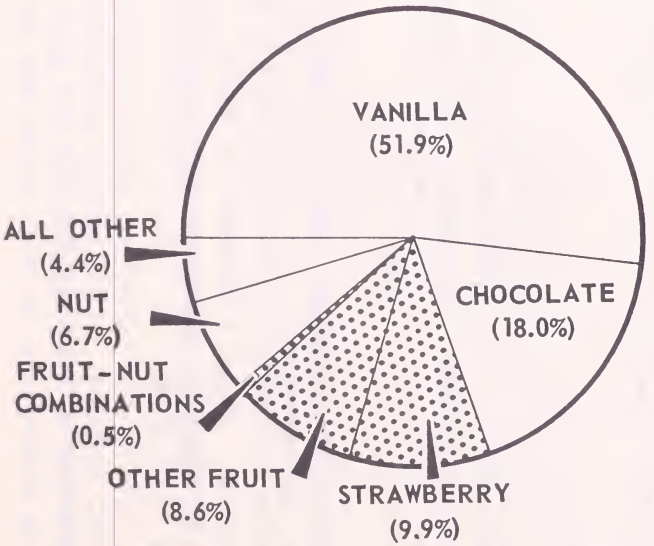
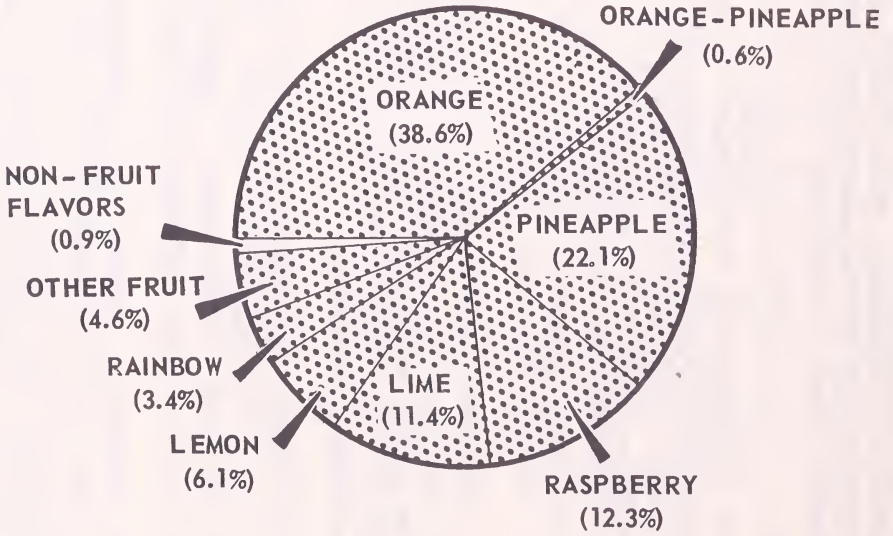
5/ This Association's Bulletin No. 87.

# FRUIT AND OTHER FLAVORS USED IN ICE CREAMS AND SHERBETS, UNITED STATES, 1952*

## ICE CREAM




## SHERBET




FRUIT FLAVORS  OTHER THAN FRUIT FLAVORS

* *FLAVOR GROUPS INCLUDE MAJOR AND RELATED FLAVORS: EXAMPLE-CHOCOLATE, CHOCOLATE CHIP, VARIEGATED CHOCOLATE, ETC.*
*INTERNATIONAL ASSN. OF ICE CREAM MFGRS.*

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The stability in consumers' preferences is borne out by the difficulties involved in achieving acceptance of new ice cream flavors. Trade sources indicate that considerable promotional effort is required to introduce new flavor items. However, the industry is reported to be searching continually for new and improved flavors.

Availability of a number of the lesser-volume flavors is reported to be an aid to ice cream merchandising. The presence of such a selection of flavors may increase overall ice cream sales either through sales of the lesser-volume items or through drawing customers to the ice cream cabinet, even though the final choice is another flavor. Seasonal specialties and other flavors make good promotional material which may affect total ice cream sales.

## Regional Variation in Fruit-Flavored Ice Cream Production

The share of the ice cream market held by fruit-flavored items varied among regions. Almost 25 percent of Southern ice creams in 1952 contained fruits in one or another form; whereas, such production accounted for between 17 and 18.5 percent in the other regions (table 14).

Table 14.--Relative importance of various fruit-flavored ice creams, by regions, 1952

| Flavor | Region 1/ | | | | | United States |
|---|---|---|---|---|---|---|
| | North Atlantic | Central Eastern | Midwestern | Southern | Western | |
| | Percent | Percent | Percent | Percent | Percent | Percent |
| Strawberry | | | | | | |
| Strawberry | 7.95 | 7.33 | 5.54 | 14.93 | 9.13 | 8.66 |
| Variegated strawberry | .23 | .73 | 4.16 | 1.16 | 2.58 | 1.25 |
| Total | 8.18 | 8.06 | 9.70 | 16.09 | 11.71 | 9.91 |
| Cherry | | | | | | |
| Cherry vanilla | 3.80 | 4.29 | 1.85 | 1.97 | 1.01 | 2.95 |
| Cherry | .57 | 1.60 | .61 | .95 | .36 | .73 |
| Cherry nut | --- | .18 | 2.18 | .24 | .31 | .35 |
| Total | 4.37 | 6.07 | 4.64 | 3.16 | 1.68 | 4.03 |
| Peach | 2.82 | 1.05 | .17 | 1.97 | .51 | 1.77 |
| Raspberry | | | | | | |
| Variegated raspberry | .20 | .92 | 1.10 | .40 | 1.45 | .64 |
| Raspberry | .29 | .07 | --- | .23 | .03 | .18 |
| Total | .49 | .99 | 1.10 | .63 | 1.48 | .82 |

Continued

See footnote at end of table.

Table 14.--Relative importance of various fruit-flavored ice creams, by regions, 1952--Continued

| Flavor | Region 1/ | | | | | United States |
|---|---|---|---|---|---|---|
| | North Atlantic | Central Eastern | Midwestern | Southern | Western | |
| | Percent | Percent | Percent | Percent | Percent | Percent |
| Banana | | | | | | |
| Banana | 0.61 | 1.04 | 0.21 | 0.35 | 0.22 | 0.53 |
| Banana nut | .06 | .01 | .11 | .75 | .22 | .17 |
| Banana bisque | --- | --- | --- | --- | .41 | .07 |
| Total | .67 | 1.05 | .32 | 1.10 | .85 | .77 |
| Pineapple | | | | | | |
| Pineapple | .69 | .11 | .17 | .45 | .12 | .42 |
| Orange-pineapple | .20 | .50 | .06 | .57 | .10 | .26 |
| Cocoanut-pineapple | --- | .03 | .07 | .01 | .27 | .06 |
| Total | .89 | .64 | .30 | 1.03 | .49 | .74 |
| Mixed fruit | | | | | | |
| Frozen pudding | .34 | .03 | --- | .03 | .03 | .17 |
| Holiday fruit | .01 | .07 | .17 | .27 | .34 | .12 |
| Tutti frutti | .04 | .10 | .27 | .19 | .15 | .11 |
| Total | .39 | .20 | .44 | .49 | .52 | .40 |
| Lemon | | | | | | |
| Lemon | .27 | .23 | .24 | .03 | .06 | .19 |
| Lemon custard | .04 | .29 | .12 | .40 | .29 | .17 |
| Total | .31 | .52 | .36 | .43 | .35 | .36 |
| Black raspberry | .37 | .12 | .12 | --- | .08 | .21 |
| All fruits | 18.49 | 18.70 | 17.15 | 24.90 | 17.67 | 19.01 |

1/ Equivalent to the Northeastern, Southern, and Western Census regions and the East and West North Central geographic divisions.

International Association of Ice Cream Manufacturers.

The use of individual fruits, and various flavors using these fruits, likewise varied regionally. In the South, for example, production of strawberry ice creams was reported to be second only to vanilla--accounting for over 16 percent of total ice cream production. Of this, almost 15 percent was in the form of regular strawberry ice cream. This pattern varies widely from production patterns in the Midwest, where total strawberry ice cream production was less than 10 percent of the total, and variegated strawberry accounted for over 4 percent.

From these data it would appear that flavor preferences tend not only to vary widely between regions but also between flavor forms. Such regional differences would be expected to affect not only the quantities of fruits required, but also possibly the form in which the fruit is obtained.

Different types of fruit-flavored ice creams containing the same fruit may vary as to the fruit content per gallon. Likewise, variations may exist as to the quantities of fruits contained in products of the same type. Thus, analysis of flavor preferences for fruit-flavored items provides a useful indicator of trend in the demand for fruits by this industry, but will not provide a close measure of such usage unless related to a reasonably firm benchmark. Information is needed as to the fruit content of frozen desserts if such a base is to be established.

When regional comparisons are made as to the share of total output represented by individual fruit flavors, it appears that peach ice cream production is of the greatest relative importance in the North Atlantic States. Cherry and lemon ice creams are most important in the Central Eastern region; as are strawberry, banana, and pineapple items in the South. The West produced a larger share of raspberry and mixed fruit items.

## Sherbets and Water Ices

During the postwar period sherbet production has risen rapidly. In 1949 production stood around 13.6 million gallons. By 1953 it approached 31 million gallons and represented about 4 percent of total frozen dessert production.

Production of water ices also showed moderate gains during recent years. In 1949 total production of water ices was almost 18.7 million gallons, compared with a volume of over 26.8 million gallons in 1953. Combined production of sherbets and water ices represented about 5.3 percent of total frozen dessert production in 1949, and over 7.9 percent in 1953.

Almost all sherbets and water ices contain fruit flavors. Information was not obtained as to the relative importance of individual flavors for water ices; however, flavor preference data for sherbets have been published by the International Association of Ice Cream Manufacturers. (See table 15.)

Sherbet production, like ice cream, is dominated by a few major flavors. The 5 leading flavors--orange, pineapple, raspberry, lime, and lemon--accounted for over 90 percent of total production. The next 5 flavors--rainbow (mixed-flavor item), strawberry, banana, orange-pineapple, and cranberry--represented an additional 7 percent. This is illustrated in figure 1. As in the case of ice creams, regional sherbet flavor preferences vary widely. These are shown in table 15.

Table 15.--Relative importance of various flavors in sherbets, by region, 1952

| Flavor | Region 1/ | | | | | United States |
|---|---|---|---|---|---|---|
| | North Atlantic | Central Eastern | Midwestern | Southern | Western | |
| | Percent | Percent | Percent | Percent | Percent | Percent |
| Orange | 37.77 | 46.03 | 42.71 | 31.22 | 38.65 | 38.62 |
| Pineapple | 11.41 | 20.33 | 18.91 | 34.71 | 26.75 | 22.06 |
| Raspberry | 27.08 | 7.53 | 9.43 | 2.63 | 7.36 | 12.30 |
| Lime | 9.67 | 12.54 | 7.47 | 26.40 | 4.92 | 11.44 |
| Lemon | 5.41 | 10.17 | 17.62 | .34 | 3.82 | 6.08 |
| Rainbow | --- | --- | --- | --- | 11.71 | 3.37 |
| Strawberry | .92 | .22 | .01 | 1.62 | 3.77 | 1.66 |
| Banana | 3.13 | --- | --- | --- | --- | .88 |
| Orange-pineapple | .08 | .54 | .17 | 2.69 | .04 | .61 |
| Cranberry | .07 | .39 | 3.05 | .32 | .48 | .60 |
| Cherry | 1.58 | --- | .50 | --- | --- | .50 |
| Grape | .67 | --- | --- | --- | .29 | .27 |
| Tangerine | .70 | .42 | --- | --- | .02 | .26 |
| Raspberry salad | --- | 1.79 | --- | --- | --- | .26 |
| Lemon-lime | .62 | --- | --- | --- | .14 | .21 |
| Others | .89 | .04 | .13 | .07 | 2.05 | .88 |
| Total | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |

1/ Equivalent to the Northeastern, Southern, and Western Census regions and the East and West North Central geographic divisions.

International Association of Ice Cream Manufacturers.

## Total Production of Fruit-Flavored Frozen Desserts

Estimated production of fruit-flavored frozen desserts in 1953 was about 172 million gallons (table 16). This sum is about 34 million gallons greater than that estimated for 1949. It would appear that fruit-flavored frozen desserts have increased their share of total frozen dessert production slightly during the period 1949-53, rising from 22.8 percent in 1949 to 23.6 percent in 1953.

On an annual basis, production of frozen desserts closely approximates consumption. Production data provide a useful measure of consumption patterns existing for specific frozen desserts--particularly regional variations. They also provide a measure of consumer acceptance, although other factors, such as product availability and price relationships, may be involved. In this regard, production data implicitly measure the consumer's choice between available frozen desserts and flavors. Generally, the consumer has a relatively wide

Table 16.--Estimated production of fruit-flavored frozen desserts, 1949-53

| Year | Ice cream 1/ | Sherbet | Water ice | Total | Share of total frozen dessert production |
|---|---|---|---|---|---|
| | 1,000 gallons | 1,000 gallons | 1,000 gallons | 1,000 gallons | Percent |
| 1949 | 106,030 | 13,616 | 18,695 | 138,341 | 22.8 |
| 1950 | 105,327 | 17,018 | 18,299 | 140,644 | 22.8 |
| 1951 | 108,081 | 20,469 | 21,683 | 150,233 | 23.3 |
| 1952 | 112,614 | 25,637 | 26,315 | 164,566 | 23.8 |
| 1953 | 114,519 | 30,941 | 26,851 | 172,311 | 23.6 |

1/ Proportion of fruit-flavored ice creams found in 1952--19 percent--held constant during this 5-year period.

choice of frozen dessert flavors--particularly of the higher volume items. Thus, it is probable that production of major frozen desserts, such as strawberry ice cream, is reasonably representative of consumer acceptance for these products. Many of the fruit-flavored frozen desserts, however, represent a small portion of total frozen dessert sales. For such items, it is possible that total production or sales figures may be somewhat less representative of consumer acceptance.

In this study no measure was obtained as to availability of individual fruit-flavored frozen desserts. Limited information was obtained as to what factors are involved in the addition to, or deletion of, a fruit-flavored item from a manufacturer's line of products. This information would indicate that price of fruit is a consideration--particularly when the cost of fruit or fruit products exceeds the cost of the basic frozen dessert mix which is displaced by the addition of these fruits. No information was gathered as to the relationship between fruit prices and the quantity of fruits used per gallon of production.

## FRUIT QUALITY

The quality of fruits and fruit products used in the manufacture of frozen desserts is a factor in determining the quantities of fruits used in this industry. The considerations involved in an evaluation of quality, however, are judged primarily by the end product--the fruit-flavored frozen dessert. It is here that the consumer passes judgment through his flavor choice among a group of available flavors and affects the volume of individual fruit-flavored items that will be produced. Thus, quality concepts would be expected to affect the quantity of fruits used in this industry, both as to volume of specific frozen desserts manufactured and the quantity of fruits used per unit of production.

Manufacturing processes in the frozen dessert industry present problems in this regard which are peculiar to this market for fruits. Flavor in the

finished product is a dominant consideration. Problems of desired flavor strength, flavor changes ("fading out" or "building up" of flavors in frozen desserts during period between manufacture and consumption), aftertaste, and "bouquet," are involved. Color and texture of the finished product are also quality factors. Tenderness, size, and color of fruit particles affect end product quality as does any formation of ice crystals within such fruit particles during the manufacturing process.

## IMPROVEMENTS IN FROZEN FRUITS FOR FROZEN DESSERT MANUFACTURE

Manufacturers were asked for suggestions or comments as to how frozen fruits and juices may be improved for use in ice cream manufacture, and also whether or not there were any quality factors which limited use of these products during 1953. This combination of questions permitted an evaluation of the intensity of the problems reported.

The specific problems reported are not new, and have been described and evaluated at considerable detail from time to time in professional and trade journals. This study is concerned more with the extent or intensity of these problems than with the technical aspects involved.

The stabilization problem drew the greatest response, not only nationally but in each of the regions except the South Central. The interest of the ice cream manufacturers reporting tended to take three major directions:

1. Desire for distinct fruit and berry segments in some ice creams

2. Elimination of ice crystals in the finished product

3. Reduction of the problem of mix dilution resulting from separated fruits and juices

The second largest number of replies stressed the need for a continuing supply of fruits with low bacterial and mold counts. Although interest in this subject was present in all regions, it was most prevalent in the South Central States.

The desire for better flavor in frozen fruits and berries tends to center upon peaches, and, to a less extent, strawberries. The need for more uniformity in frozen fruit pack appears to stem from several types of variation:

1. Pounds of fruit per container

2. Fruit-sugar ratio

3. Fruit flavor and quality

4. Quantity of separated juices

Such variations are reflected in differences in flavor, texture, or fruit content of the frozen dessert unless compensating adjustments are made in the basic frozen dessert formula.

The comments as to a need for better fruit-sugar ratio for frozen fruits and berries appear to bear the connotation that the customary 3 + 1 pack may contain less than the optimum amount of sugar for use in ice cream manufacture. Stabilization, fruit flavor, and sweetness (including sugar) are considerations reported. Uniformity in sweetness is indicated to be a sideline factor which affects adjustments in ice cream mixes necessary to obtain an optimum quality product.

Although the problem has been identified, some trade sources indicate that the question as to what fruit-sugar ratio is best for ice cream manufacturing evidently awaits further research along with the corollary question as to the effect of various types of sweetening agents.

## ESTIMATED FUTURE USE OF FRUITS IN FROZEN DESSERT MANUFACTURE

Fruit usage in the commercial manufacture of frozen desserts by 1975 can be estimated upon the basis of information gathered in this study, together with official estimates of population and income trends. A detailed report of assumptions and methods used in making these projections is found in the Appendix.

By 1975, if the considerations in the hypothesis hold true, it is estimated that total production of frozen desserts may approach 1,200 million gallons, an amount more than 60 percent greater than 1953 production.

Such a volume of frozen dessert production would be expected to require around 190 million pounds of fruits (fresh weight equivalent). If about 80 percent of these fruits are purchased in frozen form, as in 1953, usage of frozen fruits by this industry should be between 150 million pounds by 1975. This would represent an increase from 1953 of about 60 million pounds in the amount of frozen fruits marketed through the frozen dessert industry.

Frozen strawberries, peaches, and raspberries would be expected to account for the bulk of any increasing demand for frozen fruits by this industry, if present fruit use patterns continue through 1975. In 1953 strawberries accounted for over 40 percent of all frozen fruits used in frozen dessert manufacture. If use of frozen strawberries were to continue at this ratio, by 1975 demand for frozen strawberries (fresh weight equivalent) would be about 25 million pounds greater than in 1953. Such an increase would be equivalent to about 13.5 percent of the total 1953 frozen strawberry pack. Using the same general relationships, the possible increase in demand for frozen peaches would represent about 22 percent of the total frozen peach pack in 1953. Rising demand for red and black raspberries would be equivalent to around 10 percent of the total 1953 frozen raspberry pack.

Such increases in demand would be significant but, as they would be occurring over a 20-year period, yearly changes would be expected to have a limited impact upon fruit production or processing. However, if the preserving industry and other major users of frozen fruits were to experience a simultaneous increase in demand for these products, the combined increase in demand would be expected to have a greater impact, both in the short- and long-range situation.

APPENDIX

## Projected Fruit Usage in the Commercial Manufacture of Frozen Desserts by 1975

By 1975, total fruit usage (fresh weight equivalent) in the manufacture of frozen desserts may have increased by about two-thirds over 1953 levels. This projection was developed to provide a guideline for consideration of long-term demand for fruits and berries through this market outlet. It was not designed as a forecast, but rather as an estimate based upon a set of assumptions. Outside forces, either economic or noneconomic, may change fruit requirements for this industry during the next 20 years.

This projection of fruit usage by 1975 was predicated upon the following general assumptions:

1. Existence of a growing economy with a high level of employment

2. An economy free of controls and restrictions associated with heavy mobilization or wartime conditions

3. Costs and prices for frozen desserts remain substantially unchanged relative to costs and prices for competing foodstuffs and relationships between market outlets for fruits remain relatively unchanged

4. Prices for fruits and frozen desserts are adequate to obtain necessary production expansion

5. Past trends in eating habits are expected to continue

Population in 1975 was assumed to be about one-third greater than the 1953 level, or around 214.6 million persons. This is the so-called Series B projection of the Bureau of the Census, and falls within the range of projections--206.9 and 228.5 millions--developed by that agency. 6/

Assumptions as to future income levels were based upon a recent USDA report 7/ which indicated that by 1975 there may be "an increase in real income

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6/ Current Population Reports, Series P-25, No. 123, "Revised Projections of the Population of the United States, by Age and Sex, 1960 to 1975." Projection B assumes (1) that fertility rates of 1950-53 will prevail until 1975, then drop linearly to the approximate prewar level by 1975, (2) mortality rates will continue to fall as in the 1940's and level off after 1960 at the 1955-60 levels, (3) net immigration will amount to 1.4 millions during 1955-60 and 1.2 millions per 5-year period thereafter.

7/ Daly, Rex F. Long-Range Prospects for Agriculture, Summary of Report presented before the National Agricultural Credit Commission, Chicago, Ill., June 6, 1955, U. S. Dept. Agr., mimeographed.

per person of about two-thirds above the 1951-53 average." This estimate was predicated upon the projections that in 1975 the economy would be producing about double the 1951-53 output of goods and services, whereas population would be about one-third greater.

## Estimated Future Demand for Frozen Desserts

Future use of fruits by this industry may be affected by changes in: (1) Total production of frozen desserts; (2) the share of these products containing fruits; and (3) the average quantity of fruits or fruit products used per unit of frozen dessert manufactured. Of these factors, changes in total frozen dessert production levels may be expected to have the greatest effect upon future use of fruits by this industry.

Since the early 1930's, production of frozen dessert has risen rapidly. Per capita production in 1953 was more than 3 1/2 times greater than it had been 20 years before. What general trend in production might be expected over the next 2 decades?

## Consumer Income and Frozen Dessert Production

Figure 2 indicates that a direct linear relationship existed between per capita disposable personal income (adjusted for changes in general price levels) and per capita production of frozen desserts during the period 1932-53. Rises in spendable income were accompanied generally by increases in per capita frozen dessert production. Furthermore, the slope of the regression line would indicate that the income elasticity for these products was relatively high. A change of 1 percent in per capita disposable income tended to be paralleled by a change in the same direction of around 1 percent in per capita frozen dessert production.

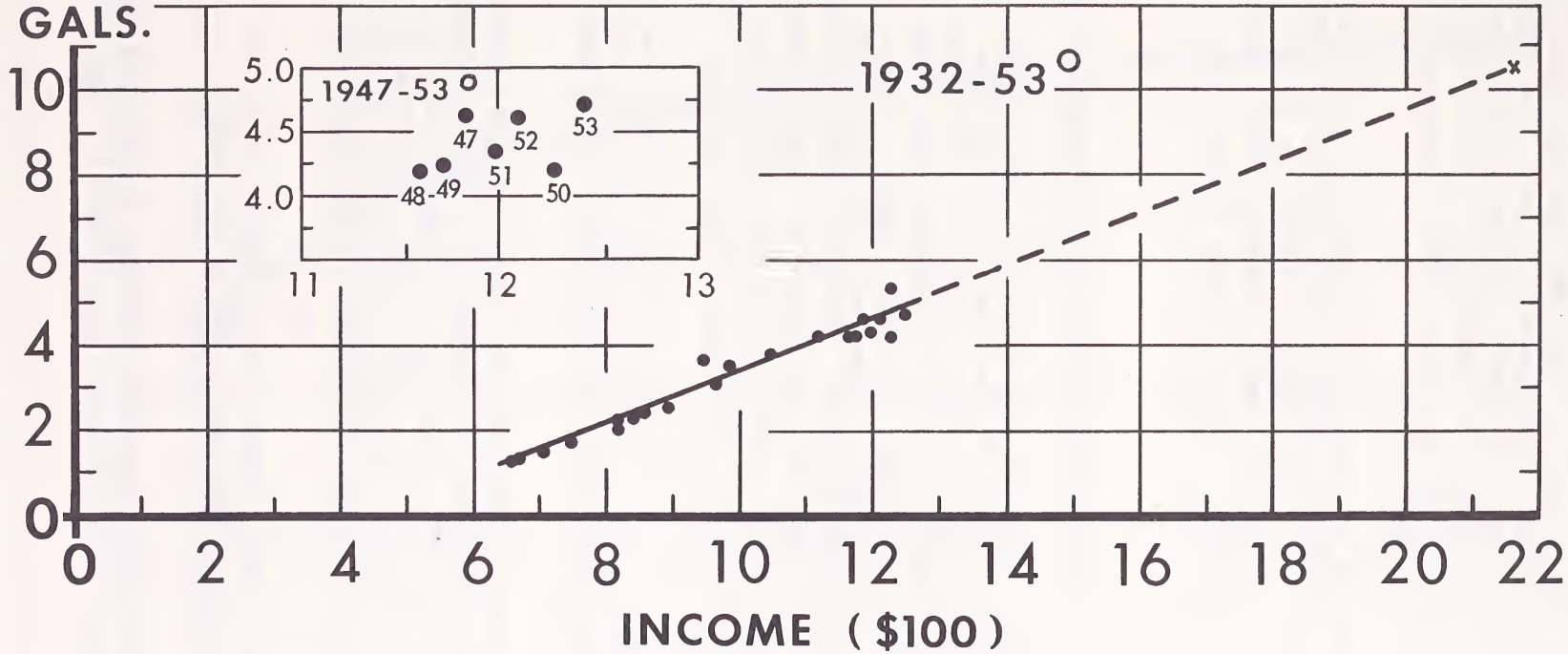
Within this 22-year period, the above income-production relationship would have served as a relatively effective tool for projecting future production levels. If this pattern were to continue unchanged through successive rises in income to the projected level for 1975, per capita production of frozen desserts might exceed 10 gallons per person. However, the observed production-income relationships, 1932 to 1953, were within a per capita income (adjusted) range of $666 to $1,245. Production responses to increases in per capita disposable income above $2,000 may or may not be comparable with those observed as incomes rose above the $1,000 level, for example.

Isolation of income-production relationships for the postwar years 1947-53, without adjustment for trend, would indicate the possibility that during this more recent period the production responses to income rises have been smaller than the averages indicated over the longer period. Per capita disposable income (adjusted) for the years 1947-53 were found between $1,161 and $1,245, and represented most of the higher income-consumption observations for the 1932-53 period.

*Per Person:*

# FROZEN DESSERT CONSUMPTION AND DISPOSABLE PERSONAL INCOME, 1932-53

*With Extension to 1975 Income Level**




* *EXTENSION OF 1932-53 LINEAR RELATIONSHIP TO PROJECTED 1975 INCOME LEVEL - AROUND $2160, (ADJUSTED) DOES NOT CONSTITUTE THE BASIS FOR PROJECTING FROZEN DESSERT CONSUMPTION BY 1975. SCATTER OF 1947-53 DATA (SEE INSERT) INDICATE LESSER SLOPE FOR CONSUMPTION-INCOME RELATIONSHIP THAN THAT FOR LONGER TERM OBSERVATIONS.* ° *ADJUSTED FOR CHANGES IN CONSUMER PRICE INDEXES (1947-49 AVERAGE).*

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Figure 2

This divergence in production responses to changes in income within this comparatively high range from that indicated for lower income levels would indicate the possibility that income and production might be found to assume a curvilinear relationship if higher potential income levels were attained. Linear projections based upon observation of portions of such a curve might be expected to overstate the possible effect of changes in future income, at higher levels, upon production.

Since there is no historical background for evaluating production responses to the projected average income levels, an indicator of such a pattern may be obtained from frozen dessert consumption data for families of varying income levels. Projections based upon such family budget data, however, are subject to the assumption that as family incomes rise, their new consumption patterns will tend to be comparable with those families already in the new income stratum.

## Urban Family Income and Ice Cream Purchases

According to a recent USDA report 8/ there appears to be a definite relationship between family income levels and purchases of ice cream. As shown in figure 3, purchases per family member in 1948 tended to increase with successive income levels, but at a decelerating rate. The largest increase in average ice cream purchases occurred as family incomes rose to about $4,000. Further increases in family income were associated with a smaller rate of increase in ice cream purchases. It would appear that the ice cream purchasing patterns for urban families with middle or higher incomes were relatively stable. Further income rises for families within these strata would be expected to have less effect upon their purchasing ice cream than would income increases of the same size for lower income families.

A major shift in family income levels has occurred during the postwar period. In 1947 about 37 percent of families had, before tax deductions, incomes of more than $4,000. By 1953 around 56 percent had incomes above this figure (table 17).

An indication of the possible impact of such a shift in family incomes upon ice cream purchases was obtained by relating average purchases by urban families in 1948 to the percentage distribution of families in different income levels during 1947 and 1953. Under these conditions the shift in the family income structure alone could have resulted in a per capita increase in ice cream purchases by around 7.5 percent during these years. 9/

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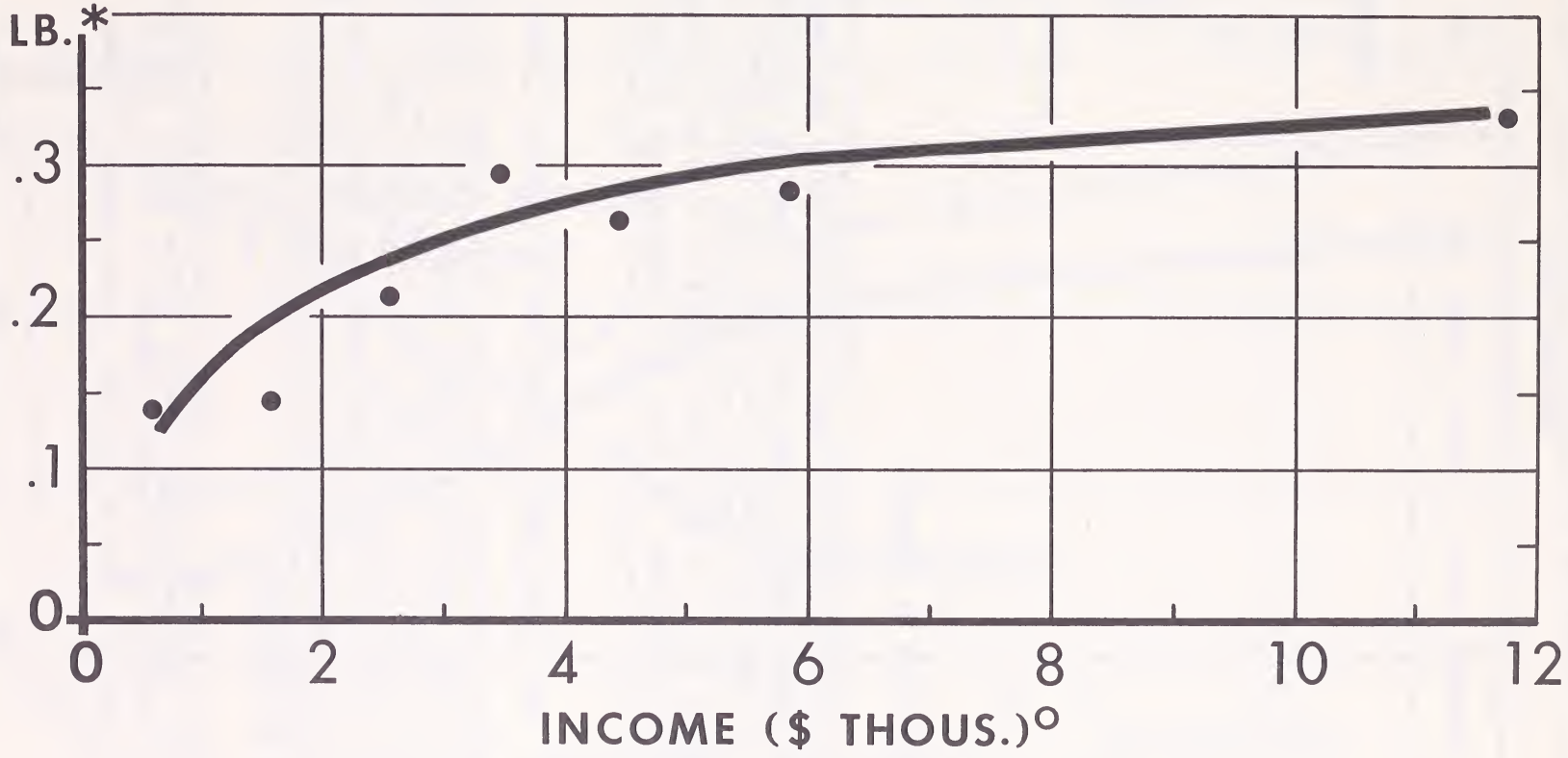
8/ Clark, Faith, Murray, Janet, Weiss, G. S., and Grossman, Evelyn. Food Consumption of Urban Families in the United States . . . with an appraisal of methods of analysis. U. S. Dept. Agr., Inform. Bul. 132, 203 pp., illus., Oct. 1954.

9/ Assumes that purchasing patterns of families with changes in income level will tend to be similar to those found for families already in the new income strata.

# USE OF PURCHASED ICE CREAMS BY INCOME CLASS

*Per Member of Urban Family, Spring 1948*




* AV. POUNDS PURCHASED PER MEMBER OF URBAN FAMILY, 1 WEEK, APR.-JUNE

° 1947 FAMILY INCOME AFTER TAXES

U. S. DEPARTMENT OF AGRICULTURE NEG. 3550-56 (9) AGRICULTURAL MARKETING SERVICE

Figure 3

Table 17.--Percentage distribution of families by specified income levels, 1947 and 1953

| Family personal income, before income taxes | 1947 | 1953 |
|---|---|---|
| | Percent | Percent |
| Under $1,000 | 8.4 | 5.7 |
| $ 1,000-1,999 | 16.5 | 10.8 |
| 2,000-2,999 | 18.9 | 12.8 |
| 3,000-3,999 | 19.3 | 14.6 |
| 4,000-4,999 | 12.8 | 14.3 |
| 5,000-5,999 | 7.8 | 12.4 |
| 6,000-7,499 | 7.0 | 12.3 |
| 7,500-9,999 | 4.8 | 9.6 |
| 10,000 and over | 4.5 | 7.5 |
| Total | 100.0 | 100.0 |

U. S. Department of Commerce.

With 56 percent of families already in income strata where relatively stable ice cream purchasing patterns are indicated, the impact of further income rises alone upon ice cream purchases might be expected to diminish somewhat. A rough approximation as to the effect of possible impact of income shifts during the next 2 decades upon ice cream purchases by relating the family purchase data for ice cream in 1948 to 1953 and possible 1975 distributions of family incomes. Within this framework an increase on ice cream purchases of about 5 percent over 1953 levels was indicated.

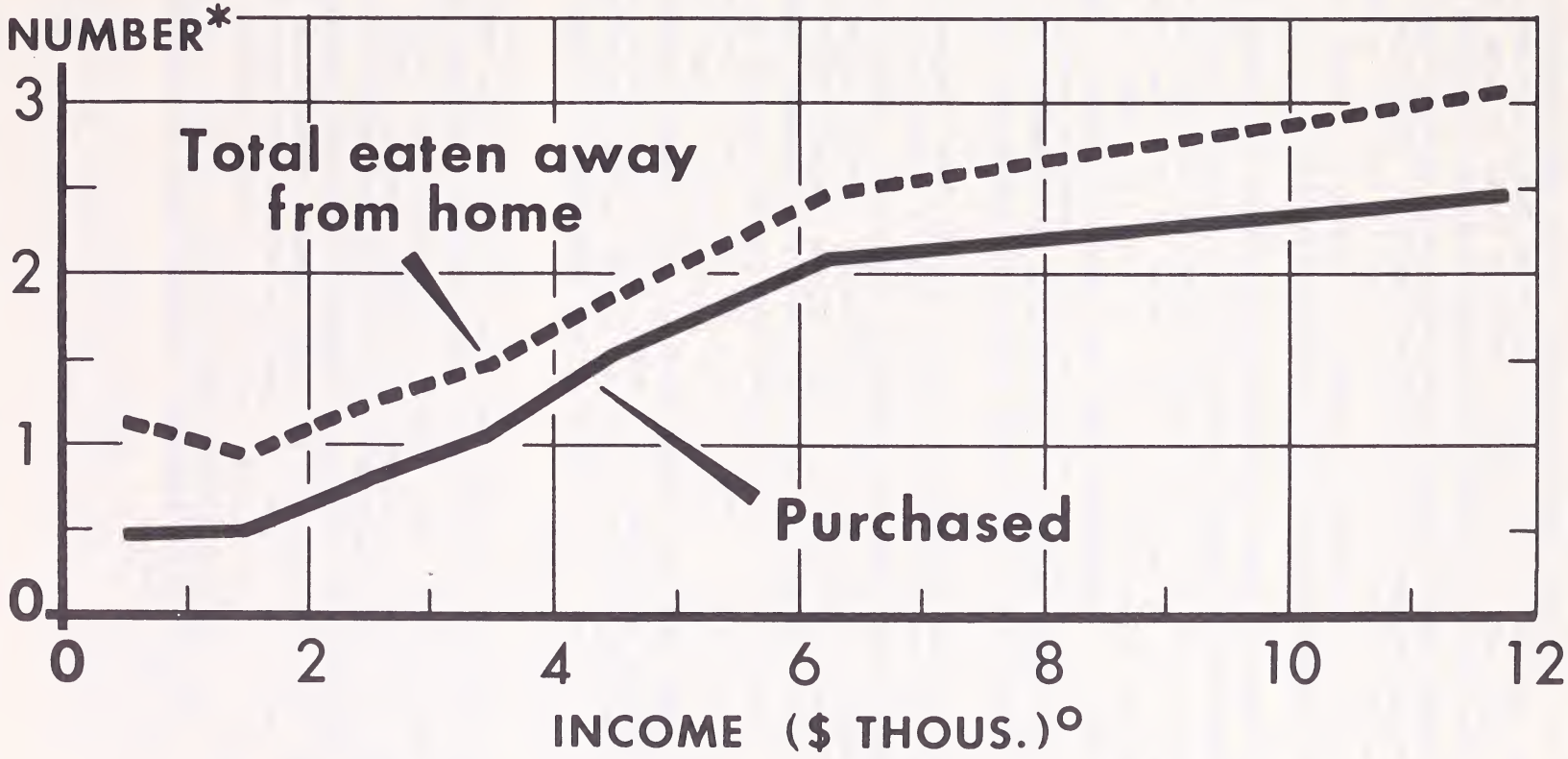
## Urban Family Income and Purchases of Meals

Restaurants, cafeterias, and other public eating places are important outlets for frozen desserts. The USDA report on Food Consumption by Urban Families (see footnote 8) indicates that a definite relationship existed in 1948 between family income levels and the number of meals purchased per family member. If this relationship were assumed to remain constant, and the average amount of frozen desserts served per meal sold to remain unchanged, an indicator of possible future levels of frozen dessert consumption through this outlet may be obtained.

As shown in figure 4, the number of meals purchased per family member tended to rise with each higher family income level. The greatest increases were noted, however, as incomes progressed to around $6,000. As incomes rose above this level the rate of increase in the number of meals purchased appeared to lessen.

# MEALS EATEN AWAY FROM HOME, BY INCOME CLASS

*Per Member of Urban Families, Spring 1948*




*NUMBER OF MEALS, 1 WEEK, APR.-JUNE

°1947 FAMILY INCOME AFTER TAXES

U. S. DEPARTMENT OF AGRICULTURE NEG. 4081-56(4) AGRICULTURAL MARKETING SERVICE

Figure 4

This relationship appears to differ from the income-ice cream purchase pattern in two significant respects. First, the rate of increase in ice cream purchases appears to slow significantly as family incomes rise above $4,000, whereas, this shift in purchases of meals seems to occur at around $6,000. Second, the rate of increase in number of meals purchased by families in the higher income levels appears to be relatively greater than the rate of increase in ice cream purchases by these same families. Therefore, shifts in family income levels, both in 1947-53 and projected 1953-75, would be expected to result in greater percentage increases in numbers of meals purchased than in quantities of ice cream bought by urban families.

When data on number of meals purchased by urban families of different income levels were applied to 1947 and 1953 family income distributions, it would appear that shifts in family incomes alone might have resulted in an increase of over 23 percent in the number of meals purchased per capita by urban families during this period. By 1975 the number of meals purchased per capita might be about 15 percent above the 1953 level. Thus, if the average amount of frozen desserts served per meal remained constant, restaurants, cafeterias, and other public eating places might be using about 15 percent more frozen desserts per capita when projected 1975 income levels were attained.

These income-consumption projections provide fragmentary evidence which indicates that projected increases in family income levels will continue to have considerable, although probably a lessening, effect upon the volume of frozen desserts produced. From these data it would appear that such rises in family income might result in a per capita increase of at least 10 percent in frozen dessert production over 1953 levels, or around one-half gallon more per person. However, it must be noted that income is only one of the factors which may affect production levels during the next several decades. Price changes, changing food habits, technological developments, promotional activities, and other economic and noneconomic factors could result in major changes in family food purchasing patterns. Thus other factors may combine with higher family income in pushing toward larger per capita production of frozen desserts or they might tend to counter some of the influence of higher incomes toward higher production levels.

This estimated increase was based, in part, upon the assumption that consumption patterns in 1948 would remain static. However, changes in this pattern are evident. For example, during the years 1949-53, a trend toward increasing production of sherbets and water ices was noted. In 1953 per capita production of these items was about 0.17 gallon higher than in 1948. If this upward trend were to continue at one-half this rate, production by 1975 would be around one-third gallon above 1953 levels. Therefore, allowing for such current trends, as well as the possible effects of higher family incomes, it would appear that per capita production of frozen desserts by 1975 might be around 0.5 to 1 gallon greater than in 1953. A total per capita production of about 5.5 gallons would represent an increase in production of around 0.75 per person over 1953 levels.

## Estimated Total Production of Frozen Desserts by 1975

If the population reaches 214.6 millions by 1975, and a per capita consumption rate of 5.5 gallons were attained, total demand for frozen desserts would be around 1,200 million gallons. This demand would entail an increased production of about 400 million gallons over 1953 levels--an increase of over 60 percent in 22 years.

This projection would indicate the possibility of an increase of considerable magnitude in frozen dessert production. However, it is noted that population growth--to 214.6 millions--might increase total demand for these products to around 1 billion gallons by 1975, even if the 1953 per capita consumption rate had remained static throughout the period.

## Production of Fruit-Flavored Frozen Desserts

Future adjustments in demand for fruit-flavored frozen desserts will affect the quantities of fruits required by this industry. An estimate of the share which fruit-flavored items will hold of total frozen dessert production by 1975 is necessary to any evaluation of future fruit requirements.

As indicated in the text, fruit-flavored frozen desserts represented almost 22.8 percent of total frozen dessert production in 1949. This share has increased steadily to about 23.6 percent in 1953. If the share held by fruit-flavored products were to increase at one-half the 1949-53 rate over the next 20 years these items would constitute about 25 percent of total frozen dessert output by 1975.

On a projected frozen dessert production of around 1,200 million gallons, it would appear that production of fruit-flavored frozen desserts might rise to around 300 million gallons by 1975. This would be about two-thirds greater than the estimated output of these items during 1953.

Technological developments may exert considerable change, however, during the next 2 decades. Development of fruit essences and concentrates, for example, may result in increasing consumer acceptance for some fruit-flavored desserts. Tropical fruit products may have an increasing impact upon this industry during this period. Promotional activities may also affect consumption. The recent increase in popularity of cherry-flavored ice creams, for example, was accompanied by an industry promotional operation. Likewise, other factors might operate to reduce the share of the frozen dessert market now held by fruit-flavored frozen desserts.

## Quantities of Fruits or Fruit Products Used in Frozen Desserts

No measure was obtained as to potential changes in the quantities of fruits or fruit products used in basic frozen dessert mixes. Technical problems are reported to set a practical maximum of fruit usage in many cases,

and State and local regulations a minimum in others. Information obtained in this study indicates the possibility that some regional differences may exist as to the average quantity of fruits used per gallon of ice cream mix.

Some changes may take place in the quantity of fruits used per gallon in frozen dessert production during the next 20 years. However, for this projection, the assumption is made that no change will occur during this period.

## Estimated 1975 Fruit Requirements

Within this framework, total demand for fruits in 1975 may be anticipated to reach into a range of 165 to 215 million pounds (fresh weight equivalent). The midpoint--190 million pounds--would represent an increase in fruit requirements of 78 million pounds from 1953 usage levels, or an increase of around 70 percent.

## Estimated Future Use of Frozen Fruits

During 1953 approximately 80 percent of fruits used in frozen dessert manufacture was purchased in frozen form. Maintenance of an 80-percent share of the market by frozen fruits during the next 2 decades, however, is subject to technological developments in fruit flavors and the continued ability of the frozen fruit industry to supply products which meet the rigid, and, in many cases, specialized standards of the frozen dessert industry. If this ratio were to continue during the next 2 decades, however, the demand for frozen fruits by the frozen dessert industry would be expected to amount to between 130 and 170 million pounds, with 150 million pounds providing a reasonable estimate. This compares with 90 million pounds used by the frozen dessert industry in 1953.

Rapid population growth and changing levels of per capita spendable income probably will exert the strongest impact upon frozen dessert production during the next 2 decades. However, the increase in average per capita disposable income, and the changing profile of the family income structure have already exerted strong effects upon marketing--perhaps more than generally realized--and will continue to bear strong influence on frozen dessert consumption levels. The combined effect of these 2 factors may be expected to exceed in importance the probable deviations in total production resulting from assumptions of static consumption patterns. Use of a projection framework is of value, primarily because it permits an evaluation of the potential impact of these 2 major considerations--population growth and changes in income level.

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